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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ENTOMOLOGY—BULLETIN No. 127.

L. O. HOWARD, Entomologist and Chief of Bureau.

PAPERS ON INSECTS AFFECTING VEGETABLE AND TRUCK CROPS.

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CONTENTS AND INDEX.

ISSUED DECEMBER 16, 1914.

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1914.

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BUREAU OF ENTOMOLOGY—BULLETIN No. 127.
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PAPERS ON INSECTS AFFECTING VEGETABLE AND TRUCK CROPS.

I. THE SPOTTED BEET WEBWORM

By F. H. CHITTENDEN, *In Charge of Truck Crop and Stored Product Insect Investigations.*

II. THE STRIPED BEET CATERPILLAR

By H. O. MARSH, *Entomological Assistant.*

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BUREAU OF ENTOMOLOGY.

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ERRATA.

Page 1, line 6 from bottom, for *Walw.* read *Walk.*

Page 1, line 6 from bottom, for *pharsiusalis* read *phrasiusalis.*

Page 7, line 2 from bottom, for *xanthamelæna* read *xanthomelæna.*

U. S. D. A., B. E. Bul. 127, Part I. T. C. & S. P. I. I., May 31, 1913.

PAPERS ON INSECTS AFFECTING VEGETABLE AND TRUCK CROPS.

THE SPOTTED BEET WEBWORM.

(*Hymenia perspectalis* Hübn.)

By F. H. Chittenden, Sc. D.,
In Charge of Truck Crop and Stored Product Insect Investigations.

INTRODUCTORY.

The spotted beet webworm (*Hymenia perspectalis* Hübn.) has attracted the writer's attention on two occasions from its occurrence on beets in the District of Columbia. It is a singular fact that it was first observed in 1905 and that its presence did not again become noticeable until after a lapse of seven years, or until 1912, when it became a veritable pest. It may be classified both as an enemy to sugar beet, because of its occurrence on that plant normally, and as an insect injurious to ornamental plants in both the garden and greenhouse. The larva is at first sight rather plain, but on closer examination it is seen to be distinctly and beautifully marked. The moth is also a most beautiful creature and has often been found flying about the District of Columbia. The food plants which will be mentioned in the present paper probably do not by any means exhaust the list.

DESCRIPTIVE.

THE MOTH.

Hymenia perspectalis is a member of the family Pyralidæ and subfamily Pyraustinæ, according to Dr. Dyar's classification. It has been described under various synonyms as follows: *Spoladia animalis* Guen., *S. exportalis* Guen., *Zinckenia primordialis* Zell., *Desmia rhinthonalis* Walw., and *Hymenia pharsiusalis* Walk.

The genus (under the name Zinckenia) is characterized by Sir George Hampson as follows:

Palpi upturned, the 2nd joint broadly scaled in front and not reaching vertex of head, the 3rd well developed and acuminate; maxillary palpi long and filiform; frons rounded; antennæ of male nearly simple, the base of shaft excised,

and a tuft of hair [rising] from basal joint; tibiæ with the spurs long and nearly equal. Fore wing with veins 3, 4, 5 from angle of cell; 7 well separated from 8, 9, to which 10 is approximated. Hind wing with vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

THE EGG.

The egg was not seen by the writer owing to the lateness of the season when continuous work was begun. We therefore have to depend upon the description furnished by Mr. Davis. He writes, in substance, that the female deposits her eggs flat and singly on the stem of the plant near the base. The egg is oval, 0.57 mm. by 0.82 mm., and being transparent pale green is quite conspicuous on the plant. Its surface is slightly convex and covered with microscopical, irregular polygonal areas appearing as a netlike sculpture on the surface.

Walker's description of the species under the name *phrasiusalis* follows:

Female. Brown, rather slender, whitish beneath. Palpi vertical, slightly curved, rising higher than the head: second joint slightly fringed; third lanceolate, about half the length of the second. Pectus pure white in front. Abdomen extending a little beyond the hind wings; hind borders of the segments white. Fore legs with brown bands. Wings moderately broad, with a cupreous tinge; markings white; fringe here and there white. Fore wings with the interior line slender, nearly straight; exterior line much interrupted, broad and regular in front; reniform mark represented by a transverse subquadrate spot. Hind wings with the exterior line broad, complete, attenuated hindward. Length of the body 4 lines; of the wings 9 lines.

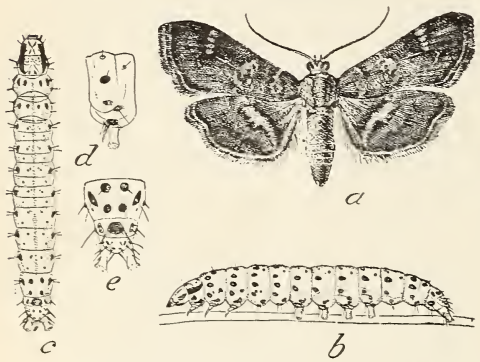

FIG. 1.—The spotted beet webworm (*Hymenia perspectalis*): *a*, Moth; *b*, larva, lateral view; *c*, larva, dorsal view, showing characteristic markings on head and joints; *d*, abdominal joint; *e*, anal joint. *a–c*, Enlarged; *d*, *e*, more enlarged. (Original.)

Less technically, this moth may be described, in comparison with the related *Hymenia fascialis* Cram.,[1] as of very similar form and having a similar pattern. The color is paler brown, inclining to cinnamon. The white fasciæ or bands are much less conspicuous, especially the second band on the fore wing two-thirds from the apex. The fascia on the hind wings is of different shape, not more than half as wide as in the other species, and more irregular. The

[1] See Bul. 109, Pt. I, Bur. Ent., U. S. Dept. Agr., November 6, 1912.

pattern is about as illustrated in figure 1, *a*. The average wing expanse is 20 mm., while the body is 8 mm. long. The venation is as shown in figure 2, and the external male characters are illustrated in figure 3.

THE LARVA.

The larva of this species is, when nearly mature, subcylindrical and somewhat depressed. When contracted it is about ten times as long as it is wide, and when extended still longer. The general color is green, brighter in the younger individuals and paler just before transformation. The head is prettily marked with purplish dots, leaving a white, longitudinal center through each half. The head is well divided, the two lobes meeting somewhat narrowly. The thoracic plate is of about the same width as the head, having a black border with conspicuous tubercles clothed with rather long hairs. Of these tubercles there are two conspicuous pairs on the first thoracic segment, with two others on each side. The second thoracic segment is very similarly marked. The abdominal segments are marked with four tubercles on the dorsum and larger ones each side. The arrangement of the spots on the anal segment is well shown in figure 1 at *e*. The location of all these tubercles is well illustrated in figure 1, the arrangement from above being shown at *c* and the lateral arrangement at *b*. The length of this larva when extended is about 20 mm. When at rest, or retracted, it is considerably less. The width at the widest portion is about 2.5 mm.

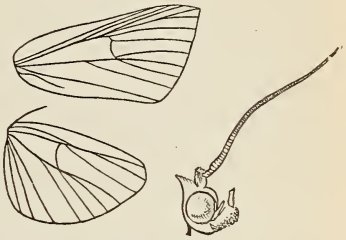

FIG. 2.—Venation of *Hymenia fascialis*, showing characters of the genus; head and antenna, lateral view, at right. (After Hampson.)

FIG. 3.—External male characters of moth of *Hymenia perspectalis*. Greatly enlarged. (Original.)

The pupa, unfortunately, was not preserved.

DISTRIBUTION.

The distribution accorded this species by Hampson is "Nearctic, Neotropical, Ethiopian, and Australian regions." Nothing is known of the origin of the species, and it is uncertain whether it comes from the Old or the New World, but it is obviously exotic and introduced into the United States. As the known species are from Africa, this may indicate the original habitat. The species is not known in Europe, but it will probably in time become cosmopolitan.

The record of injurious occurrences includes only Brooklyn, N. Y., and Washington, D. C. Undoubtedly the species occurs in troublesome numbers in many localities, but no records are available.

Through the kindness of Dr. H. G. Dyar and from other sources I am enabled to furnish the following distribution:

Washington, D. C., October 1, 1879.
Kansas, September, 1872.
Ohio.
Georgia, April, 1879.
Hurricane Mills, Tenn. (G. G. Ainslie).
Brownsville, Tex. (McMillan).
Tryon, N. C., July 3, 1904 (W. F. Fiske).
Dallas, Tex. (Boll).
Texas (Belfrage).
Miami, Fla. (Schaus).
Pernambuco, Brazil (Koebele).
Oaxaca, Mexico.
Grenada, British West Indies.
St. Lucia, British West Indies
Guatemala (Cockerell).
Costa Rica (Schaus).
Panama (Busck).
Venezuela.
French Guiana.
Peru.
Rio de Janeiro, Brazil.
Newark, N. J.
Cuba.
Sarawak, Borneo.
Central America.

NOTES ON OCCURRENCE.

ATTACK ON BEETS AND CHARD.

October 1, 1905, the writer first observed this species in a small colony on sugar beets growing in the insectary garden connected with the Bureau of Entomology. The insect was studied at that time with sufficient care to enable a drawing of the larva to be made, which is presented herewith. The moth, however, was not reared because of an accident which occurred to the rearing jar in the writer's absence.

September 30, 1912, after a lapse of seven years, this same species was again detected by the writer and readily recognized from the drawing previously made. It was first noticed and caused considerable injury on Swiss chard growing in the grounds of the Bureau of Entomology. The infestation covered one-half of a row of chard, where the damage was practically complete. Injury, however, was complicated by another insect with which it was associated, the spinach or beet flea-beetle (*Disonycha xanthomelæna* Dalm.), which had been injurious to the same plants in an earlier and a later generation and was still at work throughout the time that the lepidopterous larva was observed, and even later. The work of both species is illustrated in Plates I and II, while Plate III shows, for comparison, a chard plant which has been slightly infested but not injured. The large holes were made chiefly by the beetles earlier in the season, and the blacker portions show where the larvæ or caterpillars did their greatest damage.

From the outset of attack it was noticed that larvæ were rarely seen during the daytime and evidently were nocturnal or practically

SWISS CHARD INJURED BY THE SPOTTED BEET WEBWORM (HYMENIA PERSPECTALIS).

[Note complete breaking down of plant, as compared with ordinary injury by the spinach flea-beetle (*Disonycha xanthomelæna*), shown in Plate II.] (Original.)

SUGAR BEETS SHOWING INJURY FROM COMBINED ATTACK OF SPOTTED BEET WEBWORM AND SPINACH FLEA-BEETLE. (ORIGINAL.)

Swiss Chard in Same Row as Shown in Plate I, not Attacked by the Spotted Beet Webworm but Showing Mild Attack by the Spinach Flea-Beetle. (Original.)

so, and that they concealed themselves about the bases of the plants near the roots and under portions of leaves or petioles which rested on the ground. This was especially noticeable at the time when the larvæ were attaining their full growth.

Subsequently, October 3, the writer, with Mr. A. B. Duckett, found larvæ of this species at work on table and sugar beets. On the sugar beets similar injury to that on Swiss chard had been done, but for some reason the larvæ were scarce. The work was quite apparent, however. On the table beets the larvæ looked considerably darker, due to the darker food plant on which they fed. They were observed at this time in all stages of growth from the first stages of the larva to the last stage. The location of the chard and table and sugar beets had much to do with the growth of the larvæ, the sun playing an important part.

On a single leaf of sugar beet taken October 4 the larvæ remained in the same position for about 24 hours. The leaf was small, and after this period, after capture, only slight growth of the larvæ could be observed, especially in the case of the younger stages.

These latter were probably in the second stage. They were very nearly white, showing very feeble markings. They measure about 3.5 mm. in length. In what appears to be the third stage the larvæ assume decided markings, but are not nearly so dark as in the next stage. They are decidedly green in color, and measure about 10 mm. in length.

In the last stage the larvæ, just before pupating, turn pale and somewhat yellowish.

The cocoon is formed in different ways—on the plant and on the ground—and is covered with more or less webbing, and sometimes with an abundance of black excrement which naturally soon grows dry.

INJURY TO ORNAMENTAL PLANTS.

On October 6, 1912, the writer observed at Iowa Circle, Washington, D. C., severe injury to foliage plants of the order Amaranthaceæ. The most seriously injured area was a large circle in one of the beds at the west end of the park. The plants were practically ruined, merely hanging together in shreds. Opportunity did not offer to obtain the larvæ because of the crowd of pedestrians and others seated in the immediate vicinity. On another plat where the plants did not receive nearly so full sunlight the larvæ were found in more abundance, but only half as much injury had been accomplished. It is plain that the first lot had mostly matured and the second lot were near maturity. The plant in question, on which the insects were most abundant, was *Telanthera versicolor*, or the Alternanthera of florists.

There were also beds of the *Achyranthes acuminata* of florists, known botanically as *Iresine lindeni*, which were slightly injured by this pest. It was noticed that the larvæ, as in the case of attack to other low-growing plants, rest chiefly during the daytime on the lower leaves and near the roots.

October 7 the writer observed much injury to several plats of Alternanthera on the grounds of the Department of Agriculture, but larvæ were difficult to obtain until the much injured lower leaves were noticed; then no trouble was experienced, Mr. Duckett easily taking about a dozen. In this case, as in others, with the exception of that at Iowa Circle, colonies of the spinach flea-beetle (*Disonycha xanthomelæna* Dalm.) were present and had been responsible for the early injury. When first collected the two species were in the proportion of five of the flea-beetle to two of the webworm, but later the lepidopterous larvæ were found to be doing the greatest damage. A few young larvæ were observed at this time.

Cut leaves of beets and refuse stems were placed near the affected Swiss chard as decoys, with the result that many larvæ were found, some within the stems and some of them on the side nearest the ground. Many were also found on and under leaves[1] which had withered.

Larvæ which transformed to pupæ October 4 emerged as moths October 25, or in 21 days. Larvæ which transformed to pupæ October 12 emerged on October 30, or in 18 days. One which pupated October 16 emerged October 31, or in 15 days, showing the length of the last generation of the season to vary between 15 and 21 days, according to temperature. None of the moths which were kept for the purpose deposited eggs, nor did any remain over as larvæ, as in the case of many related species in hibernation. Hence it is doubtful if this species really hibernates in the District of Columbia, and it may be that the region is reached by moths which fly from more southern places in warm days in spring or early summer. At any rate injury has never been noticed until the autumn. One moth was captured by the writer as late as December 10 in the insectary. It might have emerged from the plants there or obtained access to the building from the outside.

OTHER RECORDS AND NOTES.

The foregoing records have been made from the writer's personal observations. In looking over the notes of the Bureau of Entomology a much earlier record was found, dated April 1, 1896, when Mr. Theodore Pergande noticed large numbers of the moth flitting about in the propagating house of the Department of Agriculture

[1] This habit of concealment on the dried leaves is a very common one among both beetles and caterpillars. *Disonycha xanthomelæna* was observed in similar locations, even on dried leaves growing high on the plants.

and was told by the gardener that this moth evidently belonged to a small larva which was doing great damage to the leaves of several varieties of Alternanthera grown in boxes and pots in the greenhouse. It was also observed that the larvæ worked mainly at night and that they concealed themselves during the daytime between the roots of these plants at the bottom of the pot.

November 27, 1909, Dr. H. T. Fernald sent specimens of this species for identification that had been received from Cuba.

November 15, 1910, Mr. D. K. McMillan, while working under the writer's direction at Brownsville, Tex., collected the larvæ of this species on Amaranthus and beets in that vicinity. The larvæ were attacking the leaves and flowers of both plants and webbing the leaves and stems. Moths were very numerous on December 6 of the same year, a few larvæ still being found on the food plants mentioned. Parasites were reared from larvæ taken November 15.

April 11, 1912, Prof. Glenn W. Herrick, of Cornell University, Ithaca, N. Y., sent specimens of the moth with report that they were reared from larvæ found very abundantly in a greenhouse in Brooklyn, N. Y., and that they were especially bad on Alternanthera.

Mr. John June Davis has forestalled the writer in publishing an article on this same species, which he terms the Alternanthera worm. He records that in 1910 this species was found eating the foliage of the variegated border plant Alternanthera, and states, what the writer has also noted, that if the larvæ are numerous enough to attract attention they usually defoliate the plant repeatedly as new shoots and leaves put forth, thus ruining it for ornamental purposes and sometimes killing it. The article includes descriptive matter, notes on habits, and suggestions as to remedial measures, among which arsenicals, hand picking, and light traps are especially mentioned.

ASSOCIATED INSECTS.

THE YELLOW-NECKED FLEA-BEETLE.[1]

(*Disonycha mellicollis* Say.)

October 8, 1912, the writer observed, in a badly infested plat not previously examined in Iowa Circle, Washington City, about 20 individuals of the yellow-necked flea-beetle (*Disonycha mellicollis* Say) congregated in a space of less than a square foot. They were in a warm place, the sunlight was strong, and hence they could all have escaped, though they could have been captured that evening. The writer captured enough specimens to be sure of the species, although this insect can be readily separated from *xanthamelæna* in life some-

[1] See also Bul. 82, Pt. II, Bur. Ent., U. S. Dept. Agr., pp. 29–32, 1909.

what better than in dried specimens. It is singular that this park should have been so badly infested by this species, while only one individual could be found in a long search on the grounds of the Department of Agriculture. The difference in distance is not more than 1½ miles.

THE SPINACH FLEA-BEETLE.

(*Disonycha xanthomelæna* Dalm.)

During the year 1912 beets as well as spinach grew very rapidly in the District of Columbia during rainy days, succeeded by warmer ones, but owing to press of other work the writer was unable to give them and their insect enemies as much personal attention as they deserved, and another reason was that the species involved, *Disonycha xanthomelæna* Dalm., has already been written up with considerable care.

Nevertheless there is always something new to learn, as there will be of all species, as long as we continue to observe them under different environments and atmospheric conditions. The table beets grew so rapidly that in spite of the larvæ and adults of the spinach flea-beetle, which "peppered them full of holes," they made considerable progress.

The spinach began to die rapidly about the beginning of the third week of June, and in four days nearly every plant appeared as if dying. In addition to the spinach flea-beetle, the spinach aphis (*Rhopalosiphum dianthi* or *Myzus persicæ* auct.) was also present, but, as affirmed by Dr. Erwin F. Smith, who, with the writer, examined the plants June 25, there was no evidence of disease or of malnutrition. If the plat of spinach had been a field, the plants would undoubtedly have perished, owing to the combined attack of the flea-beetles and the aphides, and this in spite of the fact that the aphides were being rapidly destroyed by ladybirds.

To determine the extent or degree of injury, comparison was made of a beet root taken from our experimental plat, which had been very little affected by this flea-beetle, with another lot which had been badly affected, with the result that it required nine of the affected roots to equal the weight of one that was practically unaffected. The small roots were picked out at random by the writer from the place most badly affected, which was at the sunny end of the plat.

It should be mentioned in this connection that plants growing where they were shaded by hedge plants were comparatively little affected by insects. This same observation has been made in connection with the imported cabbage caterpillar (*Pontia rapæ* L.), which is not disturbed by wasps when feeding in shady places.

FIG. 1.—MOTHS OF THE SPOTTED BEET WEBWORM (HYMENIA PERSPECTALIS), MALE ABOVE AND FEMALE BELOW. MUCH ENLARGED. (ORIGINAL.)

FIG. 2.—MOTH OF THE HAWAIIAN BEET WEBWORM (HYMENIA FASCIALIS). MUCH ENLARGED. (AFTER MARSH.)

Evidently this and other species of flea-beetles, or at least many of them, are in the habit of feeding to some extent in sunshine as well as in shade.

In regard to remedies for the spinach flea-beetle, while conducting some experiments in July, 1912, F. H. O'Neill, student assistant, spraying for cabbage butterflies and honey bees,[1] to see if sweetened and poisoned substances would kill any of them, observed that a mixture of arsenate of lead used at the rate of 6, 12, and 25 pounds, and similar amounts of molasses, to 100 gallons of water, did not destroy the butterflies or bees, but about 60 dead individuals of this flea-beetle were counted beneath the radishes July 16. The flea-beetles were not in particular evidence during these days; but they had "peppered" the beets with the usual small holes and must, therefore, have been abundant about the roots of the plants and come up to feed on the leaves, to their very swift undoing. It was not expected that the poison would kill either the butterflies or the honey bees which were present, and these were practically all unharmed.

THE HAWAIIAN BEET WEBWORM.

(*Hymenia fascialis* Cram.)

In a single instance the Hawaiian beet webworm (*Hymenia fascialis* Cram.) was reared from Swiss chard with the spotted webworm at Washington, D. C. Moths issued on October 7. The chard is a new food plant. The species is recorded by Marsh as attacking table and sugar beets, stock beets or mangel-wurzels, and several species of Amaranthus, Euxolus, purslane (*Portulaca oleracea*), cucumbers, and chenopodiaceous weeds. The moths of the two species are shown, for comparison, in Plate IV.

NATURAL ENEMIES.

On several occasions during October the last two stages of the nymph of the spined soldier-bug (*Podisus maculiventris* Say) were observed attacking the larvæ of the spotted beet webworm. This was the only predaceous insect observed, although there are probably several others.

The same is true of the parasitic enemies, a single one being noticed, a small braconid, *Hemiteles* sp. (Chttn. No. 2194°). This latter was reared October 7.

The very closely-related *Hymenia fascialis* has several parasites, and the probabilities are that if the present species were studied more carefully in other regions a number of other natural enemies would

[1] These experiments were made at the request of correspondents.

be discovered. Undoubtedly also wasps of the genus Polistes, besides *Limnerium hawaiiense* Cram., *Chelonus blackburni* Cram., and *Cremastus hymeniæ* Vier., enemies of *H. fascialis* in Hawaii, will attack this species in its larval condition.

CONTROL.

It is obvious from the notes on the occurrence of this insect that injury was discovered too late for the application of insecticides. In practically every case the larvæ were in the last stage, the few younger larvæ merely indicating the exception to the rule. Such being the case it was not possible to test any remedies whatever. It is interesting to relate, however, in the case of Swiss chard, that many of the plants, being able to withstand a considerable degree of cold, recovered and put forth new leaves, practically a second crop of leaves developing, and that the moths hatched from all larvæ and did not deposit eggs, at least not in confinement. What they would do under natural conditions is not quite certain for this latitude.

In the case of the related Hawaiian beet webworm, Mr. H. O. Marsh has demonstrated that Paris green applied at the rate of 2 pounds in 100 gallons of water did not burn beet foliage, and the same would be true of chard and the ornamental plants which this species attacks. Whale-oil soap at the rate of 8 pounds to 100 gallons of water is added, and serves as an effective adhesive agent or "sticker," thus enabling a more even distribution of the poison over the leaf surfaces.

In addition to Paris green, Mr. Marsh demonstrated that nicotine sulphate, used at the rate of 1 fluid ounce to 4 ounces of whale-oil soap and 4 gallons of water, sprayed upon cabbage, resulted in the destruction of other small and larger larvæ. He expresses the belief also, reasoning from analogy, that this formula, although not actually tested on Hymenia larvæ, would probably prove entirely effective.

Arsenate of lead and arsenite of zinc should both be tested for this insect should it occur in numbers and an opportunity be afforded for an early application of these poisons as sprays. The most important item in the control of this insect is the detection of injury early in the season, before actual damage is accomplished. Among other remedies fall plowing should be practiced. It is unwise to grow susceptible plants in the same locality in which this insect has been abundant the previous season.

There is no proof as yet that as far north as the District of Columbia this species will in the near future renew attack or become as bad a pest as in 1912. The possibility exists, however, and a close lookout will be kept for its reappearance.

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PAPERS ON INSECTS AFFECTING VEGETABLE AND TRUCK CROPS.

THE STRIPED BEET CATERPILLAR.

(*Mamestra trifolii* Rott.)

By H. O. Marsh,
Entomological Assistant.

INTRODUCTION.

Among the caterpillars or "worms" which infest sugar beets in the Arkansas Valley in Colorado and Kansas is the so-called garden Mamestra or clover cutworm (*Mamestra trifolii* Rott.). This insect is ordinarily one of the minor beet pests, although during some years it develops in sufficient numbers to cause noticeable damage. The writer had this insect under observation in the Arkansas Valley during portions of four years (1909–1912), and this article is based on notes made during those years.

In the Arkansas Valley the larvæ were found on two plants only—sugar beet and lamb's-quarters (*Chenopodium album*). Sugar beet appeared to be the favorite.

EXTENT OF INJURY.

Except in the year 1911 the larvæ were rare and caused practically no damage throughout the years the species was under observation. During 1911 hundreds of beet fields were examined in the territory between Pueblo, Colo., and Garden City, Kans., and almost without exception the larvæ were found on beets in all of these fields. The larvæ were most abundant and generally distributed during the middle and latter half of June. During this month about 75 acres of small beets in various portions of the valley were observed to be stripped of foliage. About 5 acres were destroyed. As a rule the defoliated beets promptly recovered and put out new leaves, but occasionally the larvæ destroyed the crowns of the plants, and when this damage occurred the plants died.

During July, August, and early September the larvæ were moderately common on beets, but the infested areas were scattered and practically no damage resulted. Late in the fall they developed in considerable numbers on beets in some fields. At this season, however, the infested beets were mature, and no noticeable damage resulted. The majority of these larvæ reached maturity during October, and many pupæ were observed during the latter part of the month and in early November. The winter of 1911–12 was exceptionally severe, and the extreme cold apparently killed the pupæ. No live individuals were found during the following spring, and the larvæ were very rare throughout the summer of 1912.

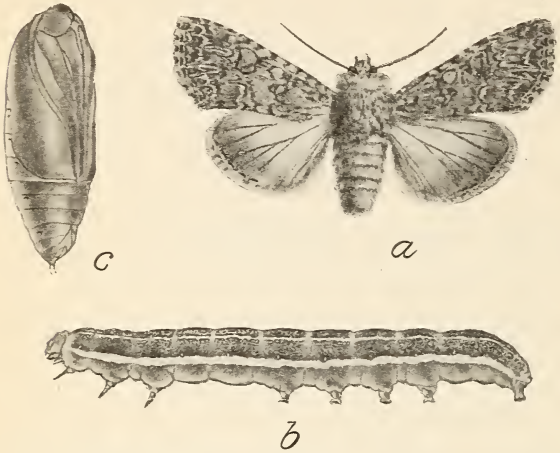


FIG. 4.—The striped beet caterpillar (*Mamestra trifolii*): *a*, Moth; *b*, caterpillar; *c*, pupa. Enlarged. (Original.)

GENERAL APPEARANCE AND HABITS.

The adult of the striped beet caterpillar is a stockily built moth belonging to the lepidopterous family Noctuidæ. (See fig. 4, *a*.) The forewings are dull grayish brown and have an expanse of about $1\frac{5}{16}$ inches. The hind wings are grayish, with brown markings. The moths are attracted to lights but are sluggish and, except for occasional individuals which may be found resting on boards, telegraph poles, and in similar locations, are seldom seen by the casual observer.

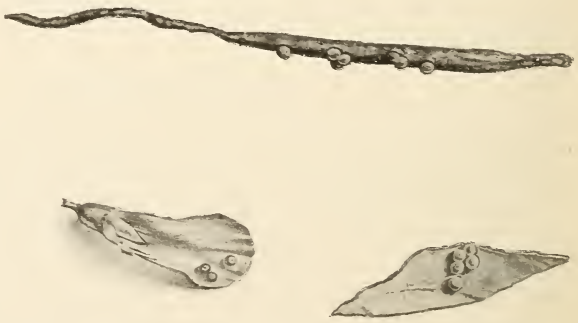


FIG. 5.—The striped beet caterpillar: Eggs. (Original.)

The eggs (fig. 5) are rather large, pearly white or pale yellow, ribbed, and hemispherical. They are deposited singly on the underside of the leaves.

The mature larvæ (fig. 4, *b*) are about 1¼ inches in length and are dull green, with a more or less distinct pinkish stripe along each side. The larvæ are voracious feeders. When infesting sugar beets they prefer the older leaves, and the infested foliage may be entirely consumed, with the exception of the petioles. The full-grown larvæ burrow into the soil to the depth of about an inch and form pupation cells in the earth by wriggling about.

The pupæ (fig. 4, *c*) are "chunky," reddish brown, and about nine-sixteenths of an inch in length.

LIFE HISTORY.

There are three generations of this insect in the Arkansas Valley each year. The first moths are to be found during the latter half of May. These deposit eggs, from which a generation develops during the first part of July. Eggs deposited by the July generation produce moths during the latter part of August and in early September. The larvæ of the third generation mature late in the fall, and the pupæ which develop live through the winter in cells in the soil. Adults develop from these pupæ during the latter half of May of the following year.

REARING RECORDS.

During 1911 and 1912 the following rearing records were obtained in the laboratory at Rocky Ford, Colo.

On June 1, 1911, a few eggs were collected in the field from sugar beets. They were deposited singly on the underside of the leaves. The record is as follows:

June 1	Eggs collected.
June 5	Eggs hatched.
June 19	Larvæ reached maturity.
June 21	First pupæ formed.
July 2	First adults issued.

From the foregoing records the stages are as follows:

	Days.
Egg stage	4
Larval stage	16
Pupal stage	11
Total	31

On June 7, 1911, two apparently mature larvæ were collected in the field from sugar beets. They burrowed into the soil and formed their pupation cells June 9 and pupated June 11. The adults issued June 29. In this case the pupal period was 18 days.

September 17, 1911, a female moth captured at Rocky Ford was placed in a cage containing sugar-beet foliage, alfalfa blossoms, and

dilute honey. She fed eagerly on the honey sirup, and on September 19, 123 eggs were deposited. The record is as follows:

September 19	First eggs deposited.
September 24	Eggs hatched.
November 4	First larvæ reached maturity.
November 10	First pupæ formed.
May 16, 1912	First adults issued.

From the foregoing records the stages are as follows:

	Days.
Egg stage	5
Larval stage	47
Pupal stage	187
Total	239

The moths which issued May 16 were placed in a cage and fed with dilute honey. The first eggs were deposited May 20. The record is as follows:

First generation.

May 16	Moths issued.
May 20	First eggs deposited.
May 25	Eggs hatched.
June 12	First larvæ reached maturity.
June 16	First pupæ formed.
July 5	First adults issued.

From the foregoing records the stages are as follows:

	Days.
Egg stage	5
Larval stage	22
Pupal stage	19
Total	46

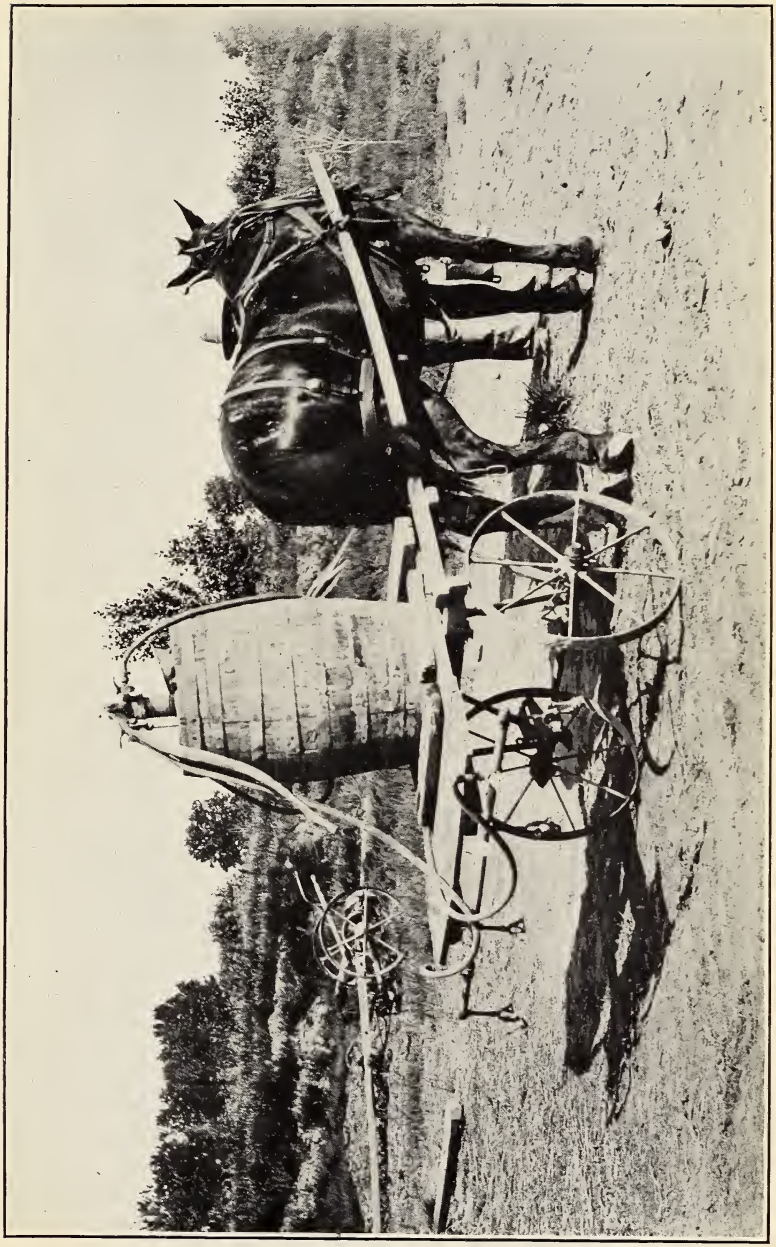
The moths which issued July 5 were placed in a separate cage and the first eggs were deposited July 11. The record follows:

Second generation.

July 5	Moths issued.
July 11	First eggs deposited.
July 17	Eggs hatched.
August 2	Larvæ reached maturity.
August 5	First pupæ formed.
August 20	First adults issued.

From the foregoing records the stages are as follows:

	Days.
Egg stage	6
Larval stage	19
Pupal stage	15
Total	40



FIELD SPRAYER SUITABLE FOR SPRAYING SUGAR BEETS. (ORIGINAL.)

Only nine moths of the second generation developed in the cages and, unfortunately, all were females. They deposited hundreds of eggs which were infertile, failing to hatch. Judging from the records which were obtained the previous fall it may be concluded that there are three full generations each year.

EGG-LAYING RECORD.

On September 17, 1911, a female moth was captured and placed in a cage. Eggs were deposited as follows:

	Eggs deposited.
September 19	123
September 20	114
September 21	82
September 22	78
September 23	82
September 24	25
Total	504

The moth died September 25.

NATURAL ENEMIES AND OTHER CHECKS.

As previously noted, the pupæ are formed in earthen cells, near the surface of the soil, in the beet fields. When the beets are cultivated or plowed out at harvest time, many of the cells are broken open and the pupæ crushed or exposed to the weather. This is an efficient check.

During the winter of 1911–12 the minimum temperatures at Rocky Ford ranged from —15° to —26° F. This exceptionally cold weather apparently killed many pupæ.

In addition to these factors in control, there are several species of parasitic and predaceous insects which serve to check the increase of the Mamestra larvæ. The following records were obtained at Rocky Ford:

Microdus inedius Cress., a braconid, was reared July 9, 1912. It is a medium-sized red and black insect with dusky wings.

Meteorus sp. (Chttn. No. 597), a smaller braconid, honey yellow in color, was reared July 11.

A still smaller species, a braconid (Chttn. No. 598), was reared August 1, but not positively identified. The body is black, the antennæ and legs are yellow, and the abdomen is marked with yellow. The larvæ of this parasite feed externally, in a cluster, on the dorsal surface of the Mamestra larvæ.

Phorocera claripennis Macq., a tachinid, was reared August 4. This fly is a common cutworm parasite.

Perilloides bioculata Fab., a pentatomid, was frequently found stabbing the partly grown Mamestra larvæ.

Phidippus coloradensis Thorell, a spider, was found rarely, feeding on the smaller larvæ.

RECOMMENDATIONS FOR CONTROL.

During 1911 the writer conducted several spraying experiments against the larvæ with Paris green, arsenate of lead, and arsenite of zinc. It was found that the larvæ of all sizes were readily killed with arsenicals. In fact this is one of the most easily controlled pests which occur on sugar beets in the Arkansas Valley.

Paris green proved more quickly effective than other poisons tested, and the following formula is recommended:

Paris green	pounds	3
Whale-oil soap	do	6
Water	gallons	100

This mixture should be applied to sugar beets with a field sprayer (Plate V) at the rate of from 75 to 100 gallons to the acre. It is necessary to wet only the surface of the leaves with spray.

CONCLUSION.

In the Arkansas Valley the striped beet caterpillar is a minor enemy of sugar beets. Ordinarily it is held in check by cultural methods and natural enemies. Occasionally, however, it develops in injurious numbers, and when this occurs the larvæ can be easily controlled by spraying with Paris green.

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